What is claimed is:

Sub a1

~~1. An apparatus for moving at least one of a pair of opposing surfaces in response to an electrical activation comprising:~~

~~a support including a rigid non-flexing portion, at least one pivotable arm portion extending from the rigid portion, a pair of opposing surfaces with one opposing surface on the at least one pivotable arm portion for movement relative to one another, and a force transfer member operably positioned for driving the at least one pivotable arm portion in rotational movement; and~~

~~an actuator operably engaged between the rigid portion and the force transfer member to drive the force transfer member relative to the rigid portion to pivot the at least one pivotable arm portion in response to an electrical activation of the actuator.~~

2. The apparatus of claim 1 wherein the support is a single piece.

3. The apparatus of claim 1 wherein the actuator is a piezoelectric device.

4. The apparatus of claim 1 wherein the rigid portion is C-shaped including a web extending between a pair of rigid arm portions.

5. The apparatus of claim 4 wherein one of the pivotable arm portions is pivotably connected to one of the rigid arm portions and the other of the pivotable arm portions is pivotably connected to the other of the rigid arm portions.

6. The apparatus of claim 1 wherein the actuator includes opposite ends and produces a spatial displacement between the opposite ends in response to an electrical activation.

7. The apparatus of claim 6 wherein the rigid portion supports a seat surface.

8. The apparatus of claim 7 wherein one of the opposite ends of the actuator is a planar surface and the seat surface supported by the rigid portion is a planar surface with the planar end surface of the actuator disposed adjacent to the planar seat surface supported by the rigid portion.

9. The apparatus of claim 8 wherein the planar end surface of the actuator applies force to the planar seat surface supported by the rigid portion in response to a spatial displacement of the actuator.

10. The apparatus of claim 9 wherein the planar end surface of the actuator operably contacts the planar seat surface supported by the rigid portion at a minimum operating spatial displacement of the actuator.

11. The apparatus of claim 9 wherein the planar end surface of the actuator operably contacts the planar seat surface supported by the rigid portion at a maximum operating spatial displacement of the actuator.

12. The apparatus of claim 9 wherein the planar end surface of the actuator operably contacts the planar seat surface supported by the rigid portion at all spatial displacements between a minimum operating spatial displacement of the actuator and a maximum operating spatial displacement of the actuator.

13. The apparatus of claim 1 wherein the force transfer member includes a seat surface.

14. The apparatus of claim 13 wherein one of the opposite ends of the actuator is a planar surface and the seat surface of the force transfer member is a planar surface with the planar end surface of the actuator disposed adjacent to the planar seat surface of the force transfer member.

15. The apparatus of claim 14 wherein the planar end surface of the actuator applies force to the planar seat surface of the force transfer member in response to a spatial displacement of the actuator.

16. The apparatus of claim 15 wherein the planar end surface of the actuator operably contacts the planar seat surface of the force transfer member at a minimum operating spatial displacement of the actuator.

17. The apparatus of claim 15 wherein the planar end surface of the actuator operably contacts the planar seat surface of the force transfer member at a maximum operating spatial displacement of the actuator.

18. The apparatus of claim 15 wherein the planar end surface of the actuator operably contacts the planar seat surface of the force transfer member at all spatial displacements between a minimum operating spatial displacement of the actuator and a maximum operating spatial displacement of the actuator.

19. The apparatus of claim 1 wherein the rigid portion, the pivotable arm portion and the force transfer member meet at one location to form a force transfer mechanism.

20. The apparatus of claim 2 further comprising an integral spring defined where at least one pivotable portion attaches to the rigid portion.

21. A method for optimizing hinge geometry comprising the steps of:

developing preliminary geometry based on defined force and displacement requirements;

performing two dimensional stress analysis to optimize orientation of hinge geometry;

designing a three dimensional model of the optimized orientation of the hinge geometry;

conducting finite element stress analysis on the three dimensional model to predict performance;

analyzing separate curves for force versus displacement for a support and a piezoelectric actuator;

identifying an intersection of the curves;

determining if the intersection of the curves satisfies the predefined force and displacement requirements;

if the intersection of the curves does not satisfy the predefined force and displacement requirements, returning to the developing step;

if the intersection of the curves does satisfy the predefined force and displacement requirements, conducting finite element stress analysis of the three dimensional model using values corresponding to the intersection of the curves;

determining if performance of the three dimensional model with finite element stress analysis using values corresponding to the intersection of the curves is verified against application requirements; and

if performance is not verified, returning to the developing step.

Sub a2

22. An apparatus according to the method of claim 21 for moving at least one of a pair of opposing surfaces in response to an electrical activation comprising:

a support including a rigid non-flexing portion, at least one pivotable arm portion extending from the rigid portion, a pair of opposing surfaces with one opposing surface on the at least one pivotable arm portion for movement relative to one another, and a force transfer member operably positioned for driving the at least one pivotable arm portion in rotational movement; and

an actuator operably engaged between the rigid portion and the force transfer member to drive the force transfer member relative to the rigid portion to pivot the at least one pivotable arm portion in response to an electrical activation of the actuator.

add a3